



The following information is provided to assist permit applicants in preparing the plans and submittals for photovoltaic (solar) electric generating systems. Missing or incomplete information may cause delays in issuing your permit. If you are uncertain about these requirements, please contact Matt Varvel at 805-781-1536 or e-mail [mvarvel@co.slo.ca.us](mailto:mvarvel@co.slo.ca.us) for assistance.

All electrical installations must comply with the adopted edition of the California Electrical Code (NEC with California amendments). In addition to the general requirements contained in Chapters 1 through 4, special requirements may also apply. See Article 690 for solar (photovoltaic) systems, Article 445 for generators and Article 480 for storage batteries and Article 705 for interconnected electrical power production sources. Other articles may also apply depending on the system configuration.

Please submit two complete sets of plans (*minimum size 11 x 17*). They must include all specifications, engineering calculations, diagrams, and/or other pertinent information needed to describe the proposed photovoltaic (PV) system. Plan submittals shall be drawn on substantial paper, clearly indicate the proposed work, and include the following information:

**A Site Plan, drawn to scale, showing:**

- Property location and boundaries of all existing buildings or other structures.
- Proposed location of solar panel arrays, inverters, and if used, generators, battery banks, and battery charge controllers.
- Location and size of the existing service equipment.
- Location of any existing easements.
- A detailed description of the system and of its components.
- The number of arrays, modules, inverters, etc.
- If the system is a stand-alone or an interactive (grid tie) system.
- The manufacturers' product data or specification sheets for the modules, inverters, array racking system, and any other major components. Be sure to identify the make and model of the equipment you intend to use.
- Please note that stand-alone PV systems must be properly sized to meet or exceed the requirements of NEC 690.10 Load calculations in accordance with NEC Article 220 to justify the system size must be included with the submittals.
- A single line diagram (*three line diagrams are required for non-residential systems*) of the entire system.
- Conductor sizes and types (consideration must be given to conductor temperature ratings, ampacity, environment, and sunlight exposure). All conductors and cables must

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be listed by a nationally recognized testing agency (NRTL) and installed in accordance with their listing.

- The maximum and minimum open circuit voltage (Voc) for each DC source circuit (series string of modules) and output circuit. See NEC 690.7 Use the following formulas to calculate voltage.  $V_{max}=V_{oc}+((T_{low}-T_{ref})\times V_{oc})$ ,  $V_{min}=V_{mp}+((T_{hi}+T_{rise}-T_{ref})\times V_{mp})$   $T_{low}$  is the ASHRAE Extreme Annual Mean Minimum Density Dry Bulb Temperature.  $T_{hi}$  is the ASHRAE 2% Annual Dry Density Bulb Temperature. See <http://solarprofessional.com/articles/design-installation/array-voltage-considerations>
- The short circuit current (Isc) for each series string of modules and for each output circuit (combined parallel source circuits).
- Note compliance with NEC 200.6 identification of grounded conductor, positive or negative.
- Note: Most battery cables and welding cables are not recognized by the NEC as an approved wiring method.
- Show all AC and DC disconnects – sizes, types, and locations.
- Indicate all conduit sizes and types and the number and sizes of conductors in each.
- Fuses and/or circuit breakers, show rating in amperes (fuses and/or circuit breakers used for direct current circuits must be listed for direct current).
- Solar panels/modules (show parallel or series connected).
- Inverters, show AC output voltage and amperage, connected to single or three phase system.
- Transfer switches – show size, type, number of poles, rating and location.
- Batteries (show number, voltage, amp-hours, series and/or parallel connected).
- Generators (show size in volt-amps or watts and voltage output).
- Battery charge controllers – include specification sheets.
- Ground fault protection (indicate if included in the inverter or separate).
- Arch fault Protection of DC circuits (indicate if included in the inverter or separate).
- The grounding system including the conductor sizes, connection points and grounding electrodes (ground rods).
- The location of all warning signs required per NEC 690-17 & 690-31E 3&4. Lettering must be permanent and not less than one quarter inch high. Stand-alone systems shall also be labeled in compliance with NEC 690.56A.
- All existing equipment and wiring shown on the plan as (E). All other equipment and wiring will be considered to be new.

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- Existing wiring and equipment that is not code compliant must be corrected.
- Note compliance with NEC 705.12 for inverter AC output connection point. Load side back feed overcurrent devices when combined with line overcurrent devices shall not exceed 120% of the panel board buss or conductor rating. In no case shall a system's design permit a Buss or conductor rating to be exceeded.

Note: All electrical equipment and conductors must be listed by a nationally recognized testing laboratory (NRTL) such as U.L., ETL, CSA. (A complete listing of nationally recognized testing laboratories can be found on the OSHA web site.)

### Roof mounted arrays weighing more than three pounds per square foot:

- Provide a detailed design for the solar collector support racks. Include engineering documentation for seismic and wind loading. Show the method of attachment to the roof, flashing details and provide engineering documentation that the existing roof structure is capable of supporting the additional loads.
- Provide scaled, dimensioned roof plans for panel placement to show compliance with the 2013 California Residential Code section 331.

### Ground mounted arrays:

- Engineering is required for arrays exceeding six feet above adjacent grade
- Show method of compliance with NEC 690.31 A & B